

REMARKS

In the Office Action, the Examiner rejected Claims 1-18, which were all of the then pending claims, under 35 U.S.C. 103 as being unpatentable over the prior art, principally U.S. Patents 6,269,322 (Templeton) and 6,498,352 (Nishi). Specifically, Claims 1-5, 8-14 and 16-18 were rejected as being unpatentable over Templeton in view of Nishi; and Claims 6, 7 and 15 were rejected as being unpatentable over Templeton and Nishi in view of U.S. Patent 5,734,594 (Chu, et al.).

Independent Claims 1, 8, 12 and 16 are being amended to better define the subject matters of these claims.

For the reasons set forth below, Claims 1-18 patentably distinguish over the prior art and are allowable. In particular, these claims are allowable because the prior art does not disclose or suggest the way, described in independent Claims 1, 8, 12 and 16, for determining the grid parameters of a wafer stage of a photolithographic tool, independent of field parameters of that tool. The Examiner is thus asked to reconsider and to withdraw the rejections of Claims 1-18 under 35 U.S.C. 103, and to allow these claims.

In order to best understand the above-mentioned difference between the claims and the prior art, and the significance of that difference, it may be helpful to review briefly the present invention and the prior art.

Generally, this invention relates to determining grid parameters for a photolithography tool, and more specifically, to determining those parameters independent of the field parameters of the tool. As explained in the present application, integrated circuits require multiple layers that need to be correctly placed relative to each another. To help accomplish this, steppers, which are common in the manufacture of large-scale integrated circuits, include an alignment system to help achieve the

proper relative placement of the layers of the circuit.

The very first level that is printed on the wafer does not have access to alignment marks; and because of this, that first level is exposed without the use of the alignment system. To insure optimum overlay for subsequent levels, it is very important that the first level formed on the wafer be exposed with known placement characteristics. To achieve these results, it is important that field systematic parameters match the associated grid parameters, and that the first level placement characteristics be consistent from lot to lot.

The present invention addresses these issues by determining or measuring grid terms, in a photolithography procedure, independently of field terms. More specifically, this is done, in accordance with the present invention, by positioning artifacts on a wafer stage a known distance apart and outside of the area of that wafer stage on which the wafer substrate is placed. In one embodiment, the distance between these artifacts is measured using the alignment system of the photolithographic tool, and the difference between this measured distance and the known distance between the artifacts is used to determine the grid parameters of the wafer stage of the photolithographic tool, independent of field parameters of that tool. In another embodiment, the artifacts are used to form first and second structures on the wafer, the offset between those structures is determined, and this determined offset is then used to determine the grid parameters.

Templeton, et al, the primary reference relied on by the Examiner to reject the claims, describes systems and methods for aligning a wafer. There is, thus, a very important difference between Templeton, et al. and the present invention. Specifically, Templeton, et al. relates to wafer alignment, while the instant invention relates to determining grid parameters of the photolithographic tool.

It is believed that the Examiner has recognized that there are important differences between the present invention and Templeton, et al, and thus also relied on Nishi to reject the claims.

Nishi describes a procedure for patterning semiconductor wafers. In this procedure, an exposing light is directed through the mask and onto the wafer, copying the mask pattern onto the wafer; and the procedure is specifically designed to improve the alignment between the mask and the wafer.

As with Templeton, et al, there also is a very important difference between the present invention and Nishi – Nishi is directed to aligning the mask with the wafer, while the present invention relates to determining grid parameters of the photolithographic tool independent of the field parameters.

In the Office Action, the Examiner specifically cited step 101 of Figure 2 of Nishi. This step is discussed in column 11, lines 33-39 of this reference. There, it is explained that, at this step, the reticle or mask 12 is subjected to pre-alignment. The present invention, however, is not directed to alignment of the reticle or mask, but instead, as mentioned above, is directed to determining the grid parameters of the photolithography tool independent of the field parameters.

Independent Claims 1, 8, 12 and 16 are being amended to better describe the above-discussed feature of the present invention. In particular, Claims 1 and 12 describe the features of determining the distance between the measured and known distances between the artifacts on the wafer stage, and using this determined distance to determine the grid parameters of the photolithographic tool, independent of the field parameters of that tool.

Claims 8 and 16 are directed to the embodiment of the invention in which the artifacts are used to form structures that are then used to determine the grid parameters. More specifically, these claims describe the features of measuring the offset between the first and second formed structures,

and using that measured offset to determine the grid parameters, independent of the field parameters.

It is noted that, in the Office Action, in the paragraph bridging pages 12 and 13, the Examiner commented that the distinction of determining "grid parameters independent of field parameters" was considered to be obvious because the prior art shows the method steps leading up to that determination.

The step of determining the grid parameters does not happen automatically after the steps leading up to the determination are taken, but is a separate and non-obvious feature. The steps of, for example, Claim 1 that lead up to the determination enable that determination, but that determination is not an automatic or necessary consequence of those preceding steps. This determination is an additional step developed and successfully implemented by the inventors of the present invention.

The claims 1, 8, 12 and 16 are being amended to describe this feature more clearly as a separate feature and not as one that simply happens automatically or whenever the steps leading up to the determination occur. It is thus believed that, as presented herein, this feature represents a separate, patentable distinction between the claims and the prior art.

The other references of record have been reviewed, and these other references, whether considered individually or in combination, also do not disclose or suggest this aspect of the present invention.

For example, Chu was cited for its disclosure of artifacts and for measuring distances between these artifacts. Chu, in column 1, lines 21-25, expressly indicates, though, that the artifacts shown in Figure 1A are on wafer W. Because of this, Chu, like Templeton, et al. actually teaches away from the present invention.

Because of the above-discussed differences between Claims 1, 8, 12 and 16 and the prior art, and because of the advantages of those differences, Claims 1, 8, 12 and 16 patentably distinguish

over the prior art, and are allowable. Claims 2-7 are dependent from Claim 1 and are allowable therewith; and Claims 9-11 are dependent from, and are allowable with, Claim 8. Likewise, Claims 13-15 are dependent from, and are allowable with, Claim 12, and Claims 17 and 18 are dependent from Claim 16 and are allowable therewith.

For the reasons set forth above, the Examiner is asked to reconsider and to withdraw the rejections of Claims 18 under 35 U.S.C. 103, and to allow these Claims. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,

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